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CREDIT-CURRENCY AND POPULATION.

IN this JOURNAL for March 1895 the writer of the present article presented some results of an inquiry made by the comptroller of the currency,[1] concerning the proportion of credit-paper used in retail payments. An attempt was made to formulate a relation between population and proportion of credit-paper used. The data were so meager that the attempt seemed over-bold, and the conclusions but slenderly supported. Two years later a second set of data was secured, much more voluminous and more representative of the habits of the people in the use of credit-paper. Although the new data seemed to support the previous conclusions, they could in no sense be regarded as proving them, and it was a question whether it was worth while to present the new evidence. Further reflection, however, strengthens the writer's belief in the probable correctness of his first conclusions. This, together with the importance of the subject, must serve as his excuse for taking up the matter anew.

The data obtained for these reports contained, among other things, a statement of the amount of deposits made in the banks which replied, on a selected day, together with the amount of these deposits made in the form of credit-paper.[2] The returns dealt separately with the returns of retail traders, wholesale traders, and "all others." The primary purpose of getting the data was to determine the extent to which credit-paper was used in payments.

Obviously, if there is a definite relation between increasing population and the quantity of credit-paper it uses, a definite line could be drawn to represent this relation, using the population numbers as points on the axis of abscissas and the corresponding amounts, or proportions, of credit-paper to indicate the values of the corresponding ordinates. Is it possible to use the data secured so as to show this, even in the roughest way? To get a true curve of such a relationship, if it exists, there are certain conditions necessary, whose importance is emphasized, if one may say so, by their absence from the statistics at hand. The

[1] See the *Comptroller's Report*, 1894 and 1896.

[2] I have given elsewhere my reasons for believing that the information secured in these reports fairly shows the extent to which credit-paper is ordinarily used in payments in the United States. See the *Comptroller's Report* for 1896.

different cities and towns should present a gradual and equable increase in population. That is, in order to yield a line that could be properly called a curve, each place should have a population larger by a constant amount than that of the one preceding it. But population does not distribute itself in so accommodating a fashion! The best we can do is to group the places from which answers came, according to size, at intervals of, say five thousand, and to take the average of the population of the places in each group as points on our axis of abscissas; and the percentages of the corresponding averages of deposits and checks for our ordinates. These averages will not give true points on the curve, but they will be approximately correct, the more so the larger the number of places in each five thousand interval, and the more nearly equal the population of the places in each group. One source of error in connection with population was the necessity of taking the figures of the census of 1890 when they were five or six years old. The use of these figures involves, of course, the assumption that the different places have the same relative positions in the scale of population that they had six years previously. This cannot be true, but as the error runs throughout our table and probably does not vary greatly between different population groups, it can hardly be of serious importance in a set of statistics so rough as those with which we have to deal.

A second condition necessary to the success of our plan is the provision of some means to offset influences due to differences in the economic character of the places grouped together. Where the number of places in a group is considerable, we may safely assume that this result is attained by the diversity which a large number of places is likely to present. Where the number is small, or even only one, we may still have a correct result, for the industrial life of the population may be so varied as to be representative. Whether or not this is so in a given case must be determined by our knowledge of the place, or places, from which the percentage is derived.

Again, since our data deal with the percentages of credit paper, we need to know if the habit of using such paper prevails throughout the country to substantially the same extent, or if differences in this respect neutralize one another. In the second report on this matter to the comptroller of the currency, attention was called to differences in what we may, for brevity, call the check habit in retail payments, arising out of differences of nationality, education, etc. These differences,

however, are not of very great magnitude, and disappear largely in our grouping of different places. For single places we can make some allowance for them.

Further, we must assume for our purposes that volume of business or of payments is approximately proportional to population. This is not a violent assumption for *retail trade*. There are other conditions which must be satisfied by any statistics that purport to give us information about the subject of our inquiry; but the discussion of these, as well as the further consideration of some we have mentioned, can better be taken up in connection with our data.

The data that we have, and any that we are likely to get, are evidently far from meeting the exact requirements of statistics that would reveal the law we are seeking, if such a law exists at all. To put the matter bluntly, we have a set of figures which are not directly applicable to our purpose and are so full of errors that the use of them as they stand would be sure to lead us far astray. Is it possible to use them indirectly to suit our purpose? Can we so adjust and allow for at least the evident errors as to neutralize them partly or wholly? Our aim is one of so much interest and importance that the trial is worth while. And mathematicians and statisticians, at least, do not need to be told that out of data of such character it is sometimes possible to get suggestions, indications, that point the way to truths which the figures cannot establish, or even fully express.

The investigations referred to produced two sets of data. The statistics obtained in 1894 refer only to retail trade and were much less complete than those secured in 1896. The former show the total receipts made in national banks in the United States on the "settlement day" following the 1st of July, by retail tradesmen of sundry kinds, and the amount of these receipts in the form of credit-paper of various kinds. In using the data for the present purpose the returns were arranged[1] so as to show the percentages of checks in the bank deposits by population groups. These groups, however, were not averaged. Various refinements of the statistics were then made showing the percentage of increase of total deposits and of checks for successive population groups, and the ratio between the two. But there were so many sources of error, and the data were so meager, that these refinements were gratuitous. If the data could be regarded as furnishing any indication of a law, it was "exceedingly remote; so much so,

[1] See this JOURNAL, March 1895.

indeed, that if we consider them by themselves we cannot be sure that they mean anything."[1] Such as the figures were, however, they are given herewith:

PER CENT. OF CHECKS USED, BY POPULATION GROUPS OF 5,000 EACH, FROM ALL RETURNS.

Population	Per cent. checks	Figures from which per cents. were calculated		Per cent. of increase of totals, group to group.	Per cent. of increase of checks, group to group	Ratio of per cent. increase of checks to that of totals (latter taken constant)
		Total returns	Total checks			
1,000– 5,000	59.1	1,494,159	883,134	....	....	.....
5,000–10,000	55.5	839,950	466,229	−56.2	−52.8	0.940
10,000–15,000	59.0	732,433	433,145	−87.2	−92.9	1.060
15,000–20,000	60.6	265,598	160,902	−36.2	−37.1	1.024
20,000–25,000	62.2	364,481	226,687	137.2	140.9	1.027
25,000–30,000	52.5	117,290	61,573	−32.1	−27.1	0.840
30,000–35,000	52.0	71,746	37,254	−61.1	−60.4	0.990
35,000–40,000	47.1	104,870	49,483	146.2	132.7	0.910
40,000–45,000	54.7	156,249	85,460	148.9	173.1	1.160
45,000–50,000	49.1	61,824	30,358	−39.6	−35.5	0.890
50,000–55,000	62.6	78,971	49,454	127.9	162.9	1.270
55,000–60,000	54.8	105,611	57,866	133.7	117.0	0.870
60,000–65,000	48.5	36,981	17,937	−35.0	−30.9	0.880
65,000–70,000	....	....	....	.....	.....	.....
70,000–75,000	32.3	29,116	9,396	.....	.....	.....
75,000–80,000	61.9	86,535	53,542	297.2	569.7	1.920
80,000–85,000	46.1	46,521	21,453	−53.8	−40.1	0.740
85,000–90,000	62.2	22,334	13,870	−48.0	−64.5	1.340

If we plot the line to represent the percentages of checks,[2] it shows a rough periodicity. The last column of the table was worked out to see whether it would give any clearer indication of the relation of the successive maximum and minimum points; but an inference can hardly be drawn from the figures, unsupported by other considerations.

On the whole, however, the data seemed to the writer to furnish some faint indications of the existence of a relation, and it was of considerable interest to secure a more complete set of statistics. An independent study of fuller data might throw more light on the matter, whether confirmatory or destructive of these indications. Such

[1] *Ibid*, p. 212.

[2] Since the averages of the population groups were not found, it is necessary to take equal distances on the x co-ordinate. This, of course, causes error. The percentages do not correspond to places differing by exactly 5,000 population. But this will not affect the general character of what we may by courtesy call the curve.

data were obtained in the inquiry made in 1896. The banks of the country were then requested to furnish their total deposits on a given day, stating separately the amounts of money and of credit-paper deposits, and distinguishing the deposits of wholesale business from those of retail, and both from the deposits of all other depositors.[1]

For our present purpose we use, as has been said already, only the statistics relating to the deposits of retail tradesmen. For the previous figures concerned only this class of business, and these statistics must represent, more fully and correctly than the others, the daily habits of the people in the use of various media of payment. The proportion of wholesale business settled by means of credit-paper is everywhere very large, and pretty nearly constant. In the figures for retail business not only are the operations of a larger number of people represented, but the variations in the use of credit-paper are much greater. Hence we can follow any indicated tendency more easily, and have more room to allow for miscellaneous causes of variation. The figures for retail trade are better for our purpose, moroever, than are those representing the deposits of "all other" classes. These latter probably represent a smaller class of the population, and very likely include more long-time payments. Moreover, the people represented are already represented in the figures of deposits for retail trade.

The following table gives the data secured concerning retail deposits. The first column shows the averages of the population of places from which information was received, at intervals of five thousand; the second column gives the number of places represented in each population average; the third, the number of banks, etc.

It is necessary here to consider a little more carefully the limitations under which these figures must be used. The larger the number of places represented in a given population group, the more likely are the data correctly to reveal the relation between population and proportion of credit-paper, if such relation exists. For, as has already been urged, we have in each group places approximately alike in population, but different in economic character, in the degree of development of the "check habit," and in other respects which affect the proportion of credit currency used. We may fairly assume that

[1] The representation and analysis of the data secured will be found in the *Report of the Comptroller of the Currency*, 1896, together with my opinion as to the real significance of the figures. *Cf.* also, JOURNAL OF POLITICAL ECONOMY for March 1897.

TABLE I.

	Averages of population	No. of places	No. of banks	Checks, etc.	Total deposits	Per cent. checks
1	1,648	2,675	3,309	$3,697,317	$5,627,696	66
2	7,915	278	564	1,520,659	2,437,509	62
3	13,096	94	220	710,547	1,128,251	63
4	18,186	50	175	611,529	934,846	65
5	22,418	37	125	487,125	800,879	61
6	28,290	20	71	228,443	395,310	58
7	33,456	12	63	166,170	285,143	58
8	33,312	13	52	230,326	383,010	60
9	43,611	9	46	222,246	361,239	62
10	48,785	7	44	192,596	321,768	60
11	54,078	5	29	85,118	149,981	57
12	59,133	5	34	267,056	395,230	68
13	63,170	4	21	106,698	177,514	60
14	70,028	1	7	17,179	28,534	60
15	74,806	2	15	61,765	143,472	43
16	77,404	3	15	98,919	189,173	52
17	82,426	3	24	80,997	183,891	44
18	88,146	2	21	103,867	167,357	62
19	94,923	1	11	48,797	70,144	69
20	105,361	2	8	99,027	145,382	68
21	106,713	1	4	425,447	535,978	79
22	132,973	4	53	670,979	870,383	77
23	140,452	1	8	31,971	59,885	53
24	162,957	3	24	352,325	451,733	78
25	181,830	1	9	159,506	230,664	69
26	205,172	2	20	203,124	290,193	70
27	225,664	1	17	132,569	206,600	64
28	230,392	1	12	93,185	155,696	60
29	238,617	1	45	203,906	344,350	59
30	242,039	1	10	117,480	155,315	69
31	261,353	1	21	372,036	470,132	79
32	297,952	2	26	302,807	459,300	66
33	434,439	1	25	220,232	376,606	58
34	448,477	1	62	817,463	1,086,732	75
35	451,770	1	17	539,932	655,804	82
36	806,343	1	22	548,057	729,100	75
37	1,046,964	1	66	1,136,193	1,445,885	78
38	1,099,350	1	36	689,936	960,647	72
39	1,515,301	1	70	1,696,907	2,136,816	79

the percentage of checks in any group, if it includes a goodly number of places, is nearly such as would be used in a place of the size of the group, in which differences in industrial character, in the "check habit," and in other material respects, were present in the proportions in which they really exist in our country.

The population groups of the table approximate more or less closely to the type, according to the number of places represented. Of course, a group of a small number of places may also be typical.

We cannot say what the minimum number may be. Further, the amounts of business in such *typical* groups, *on a common average of prices*, would be proportionate to their numbers. The various industries are carried on by workmen of the same average ability, with similar tools, and under similar conditions. Of course, no one population center, no city, town, or village, of this typical character exists. But every place with a considerable diversity of industry approaches the type, the more so the more nearly its industries in number, volume, and character are representative of the industries of the country at large. If the number of banks represented is large, for a group in which the number of places is also large, the probability of the accuracy of the data secured is obviously increased, provided there is no reason to think that the distribution of the banks is bad. If, however, the number of banks which furnished data for a population group is large, while the number of places is small, there is possibility of serious error. The peculiarities of a place will be exaggerated the larger the number of its banks. If the data in any instance are bad from this cause, they will be, like the little girl in the story, very bad. In the one or two instances in which this occurs, however, we may be able to find means to make allowance for this disturbing cause.

One other difficulty lies in the fact that the deposits from which the percentages are drawn represent a larger amount of business than the retail payments of a day would amount to. As the writer has pointed out elsewhere,[1] this excess may mean either that the deposits of credit-paper included payments of accounts of some standing, or that retail purchases keep ahead of consumption by so much. The latter is the better explanation, because, so far as investigated, the proportion of credit-paper in deposits did not vary materially from day to day for a month.[2] But whatever view is taken of the cause, if the excess of payments over consumption were in the same proportion in all cases, the *relative* variations of the credit-paper percentages would not be affected. This constancy cannot be expected, however. Hence, we must expect irregularities from this source, and cannot correct them.

Turning now to the table, we find a succession of alternate high and low percentages, but at intervals by no means regular. We can follow the course of the figures more easily if we plot them. We get

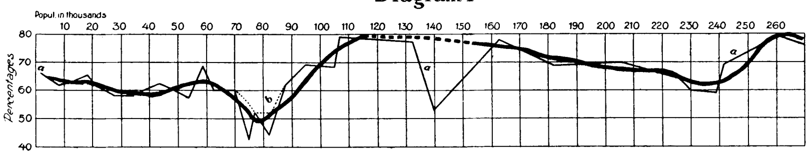
[1] See *Report of the Comptroller of the Currency*, 1896, and this JOURNAL for March 1897.

[2] See *Report of the Comptroller of the Currency*, 1896, p. 85.

the line *a* of diagram I, through the point representing the population group of 261,000. Beyond that the points are too widely separated to permit the drawing of a continuous line. The thick line is simply a free representation of the general course of the curve.

The points on the axis of x are at fairly regular intervals of approximately 5,000 up to the twenty-fourth place, of 163,000. From this point to the thirty-second place (297,952) the intervals are longer, but sufficiently numerous to give the general trend of the curve, as, for brevity, we shall call it. Beyond this, especially between the thirty-fifth and thirty-sixth places, the intervals are too great to give us any reliable indications. Leaving for the present the discussion of details and corrections, let us first look at the curve as a whole.

Diagram I



An examination shows that up to the 260,000 point it consists of at least two great waves, each of which is made up of a series of smaller waves. The first great sweep extends to the group whose population is somewhere between 100,000 and 160,000. The points on the wave are numerous enough, up to 100,000, to justify us in thinking we have its general course fairly well determined. Of its course between this point and 160,000 we cannot be so sure. At 106,713[1] we have the percentage 79. But it is derived from the returns of Denver alone, and is doubtless too high. Four banks are represented, and the average per capita deposit is $5.00. The percentage cannot be representative. At 132,978 we have a percentage of 77, from 53 banks, in 4 places. At 162,957 we have 3 places and 24 banks represented, yielding a percentage of 78. It seems certain that between 105,361 and 162,957 we are in a region of high percentages. This is said in spite of the depression at point 140,452. The percentage here is given by Omaha alone, the returns of 8 banks being included. It cannot be typical, for Omaha is economically peculiar. Moreover, we know now that Omaha does not belong

[1] The groups 105,361 and 106,713 represent different 5,000 intervals. For this reason they are not combined, though so close. Moreover, the latter is so abnormal that a combination would be colored almost exclusively by it.

at this place in the population schedule. If we put it where it belongs, after the eighteenth place, its percentage would harmonize more with the others. On the whole, the evidence seems to justify us in concluding that the first great sweep of the curve ends in a high point somewhere between 130,000 and 160,000. From here on we have a second great sweep of similar character, apparently ending in the neighborhood of the 260,000 point. Beyond this the data are too meager to give a continuous line. There appears to be a depression between 300,000 and 430,000, and a high point somewhere beyond 450,000.

If we draw[1] the first two sections of the curve on the same scale, under each other as in Diagram II, we notice at once a striking similarity of general character. The heavy lines are approximate average lines drawn to bring out the similarity. Each section shows a gradual decline for about two-thirds of its distance, and then a sudden rise. The maximum and the minimum points of the second section are higher than those of the first. The group of percentages towards the end of our table averages higher than anywhere else.

The great depressions in the two sections represent the returns of cities,[2] several of which have an industrial character that leads us to look for a low percentage of checks. We are not here concerned with the question whether there is a connection between size and economic character of communities. It may be that a certain economic life is associated with a population of a certain number, or of multiples of that number. That is a question for the sociologist, and his data for answering it are meager enough. Here we can simply note the facts that the industrial population predominates at these points, and that our percentages of credit-paper, therefore, fell away.

Let us turn now to a somewhat more detailed examination of one of the sections of the curve. Since the points are most numerous in the first section, it is this that will best serve for our study. The curve is tolerably smooth through the first eleven points furnished by the figures. The table shows that each of these points is determined by a number of places in no case less than 5, and a number of banks

[1] The thin lines *a* and *c* are plotted from the figures, *a* representing the first section, up to 95,000; *c* representing the second section, from 163,000 to 260,000. Line *a* has been smoothed out as described later.

[2] Fall River and Scranton are in the first section; Toledo, Worcester, and New Haven in the second.

in no case less than 29. The percentage of checks (66) for the places below 5,000, is probably too high, because the deposits in the small agricultural districts very likely include a disproportionate amount of time accounts. But we have no means of testing this supposition, and must use the figures as they stand. No reason appears for questioning the representative character of the other percentages in the first eleven places. The sudden rise at the twelfth place is due mainly to Trenton, N. J., and Portland, Ore. But the business character of Portland is peculiar, and Trenton is possibly largely influenced by New York and Philadelphia. The percentage is probably too high.[1] But we have, again, no means of correction. The important thing is that hereabouts we find, or seem to find, the turning point of an upward movement.

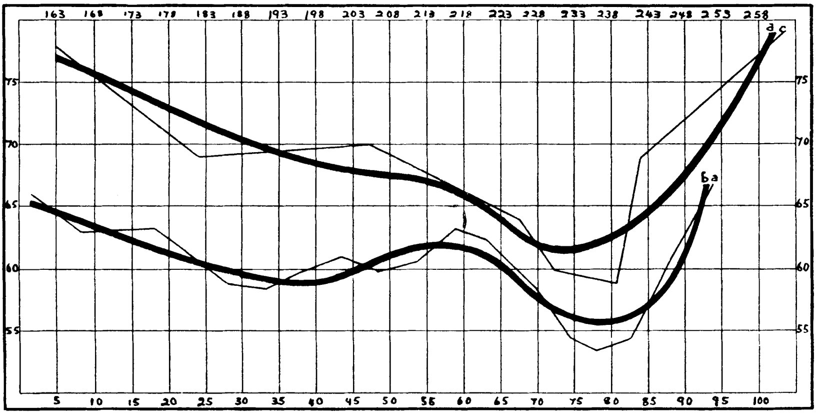
At the fifteenth place the line marks a sudden and great dip, and immediately rises again. It falls from 60 to 43, and then rises to 52. The two cities which yield the average 43 are Fall River and Scranton. The former is a textile manufacturing city; the latter a mining city. A large proportion of the population of each is of foreign extraction. These facts lead us to expect a percentage of checks below the average,[2] but 43 seems too low. For, curiously enough, the low average is due to the *national* banks of Fall River. Without their $72,083 deposits and $22,783 checks, the percentage would be 55, a figure which seems more like what we should expect in an average group of the size and character of the fifteenth. This statement is supported by the fact that if we combine the returns of the group above with those of that below (14 and 16) the one under discussion, we get a percentage of 53 for an average population of 75,560. We may fairly replace the percentage of the table, 43, with 55. The seventeenth percentage also seems too low. The cities included are Toledo, Worcester, Mass., and New Haven, Conn. If we omit Toledo, the percentage becomes 52; and if we derive an average from a combination of the preceding and the succeeding group, we get 56. We will replace our 44 with 52. In any case, it seems that we are here in a region of low percentages. The twenty-first and twenty-third groups have already been discussed. Doubtless 79 is too large for the former, and 53 too small for the latter. We

[1] The other places in the group are: Lincoln, Neb.; Reading, Pa.; and Lynn, Mass.

[2] See the *Report of the Comptroller of the Currency*, 1896, p. 82.

have no means of verifying or correcting the figures, and we will omit these points in this connection. If, now, we make the changes suggested at the fifteenth and seventeenth places, and replace the original figures with what we will call, for brevity's sake, the corrected figures, our curve changes in these places as shown in line *b* of Diagram I. In order to bring out its character more clearly, we will smooth it out by one of the processes known to mathematicians, and it becomes line *a* of Diagram II.[1]

DIAGRAM II



Inspection shows a succession of high and low points at fairly regular intervals. We find elevations and depressions at those places which are removed from preceding high points or low points, respecttively, by about twelve or thirteen population groups of 5,000 each. That is, elevations succeed one another at intervals of about 20,000. Thus there are elevations at the beginning, at 18,000, 40,000, 60,000, and 90,000. Beyond this the curve is not detailed enough for these lesser observations.

[1] We weight the values of x, using the formula,

$$y_r = \frac{(x_{r+1} - x_r)\,(y_{r-1} + y_r) + (x_r - x_{r-1})\,(y_r + y_{r+1})}{2\,(x_{r+1} - x_{r-1})}.$$

The percentages become :

1.	[66]	5.	61.6	9.	61	13.	62.6	17.	54.3	21.	....
2.	63.1	6.	58.7	10.	59.8	14.	58.5	18.	60.9	22.	77
3.	63.2	7.	58.5	11.	60.5	15.	54.6	19.	66.7	23.	....
4.	63.4	8.	59.9	12.	63.3	16.	53.6	20.	70.6	24.	78

It would be useless to try to read finer details in our data or our diagram. The last curve is as detailed a representation as we can hope for of the course of percentages, and it is from the character of this curve and the general trend of the grand sweeps that we may draw inferences. For convenience, we may here summarize the observations made:

1. The curve as a whole seems to contain two large sweeps, or sections, similar to one another. Each section shows a gradual descent to its depression, and then a more rapid rise to its end. The general level of the second large wave is higher than that of the first, and the curve as a whole shows a gradual ascent.

2. Each large wave is itself made up of a series of waves of lesser amplitude, showing a rough periodicity.

3. The curve appears to rise less rapidly in its later stage than in its earlier. Its rate of departure from the horizontal appears to lessen as it progresses. This tendency is not very marked, yet it is sufficiently evident.

What, now do these features mean? Like the physiologist, we have traced on a lampblack surface our line of social pulse-beats. What facts of life can we read in it? With full sense of the danger of making mistakes, and remembering the limitations of our data[1] we may venture to interpret the characteristics of our curve in the following law:

1. The proportion of credit-paper in the existing medium of payment, or exchange, increases on the whole, as a population grows.

2. After a community has reached a certain size, or a certain density of population, the *rate* of increase in the proportion of credit paper in the medium of exchange, decreases.

3. This increase, however, is not regular and steady, but broken and in some degree periodic. The progress is by leaps. These leaps are not a simple series. A growth of population over a considerable period shows a gradually falling use of credit-paper for a time, then a somewhat rapid increase. But within this large population unit are smaller units, each of which shows a variation of its own.

4. The actual proportion of credit-paper varies according to the industrial character of a community; but there seems reason for

[1] Especially that we are dealing with *retail* payments, and the assumptions (1) that these represent correctly the varying demand for medium of payment, and (2) that the volume of (retail) business varies closely as population.

thinking that the *relation* between growing population and demand for credit-paper is independent of industrial character.

The way we have been following is broken and faint and dubious. Were our figures all we had to rely on, we might hesitate to say that they tell us anything beyond the unrelated facts that such and such were the amounts and character of the bank deposits at the time selected. Even were our statistics full, even did they fall into unbroken line and regular relation, we might hesitate to believe the story they seem to tell, unless we could see some reason *why* it should be true. Statistics do not show causes, but facts. They tell us what is, not why it is. They are a tool of the scientific positivist. If we cannot see the rationale of a set of statistical data, we do well to insist on repeated presentations of them under different conditions, before we accept the empirical conclusions which they set forth. But the inferences from a single collection of data, even if they are imperfect, may be accepted if they are sufficiently supported by *a priori* reasons, if we have other grounds for believing in their probability. If we can say, there are such and such reasons why this must be so, we strengthen the case immensely.

How is it with our data ? They are both meager and unrepeated. But the inferences which we have drawn from them are supported by reasons founded on well-known facts of economic life. We must emphasize anew the point that we are dealing with communities in which the use of credit-paper for making payments is common ; in which the credit habit, as we have called it, is well established. Such a community has a choice of means of payment, and no *a priori* prejudice in favor of any one. The choice depends altogether on comparative ease and convenience ; and the community instinctively adopts the means which are, on the whole, least costly[1]. That this is the case with the ordinary American community is a fact which hardly needs proof ; and it is becoming more true of every community, the world over, as the industrial and mercantile spirit becomes more intense and competition supersedes custom in economic affairs.

Premising this, we turn to ask what *a priori* support we find for the inference that the proportion of credit-paper in payments rises for a period of large increase of population. Our premise suggests a

[1] This statement does not contradict President Hadley's, that a community uses a dearer money material as it rises in the scale of economic life. (*Economics*, p. 184) The dearer material is, however, the more efficient and therefore the less costly.

reason at once. The credit habit being well established, the growth of population and business is accompanied with an extension and refinement of credit machinery, which render possible a more than proportionate increase in the use of credit-paper. As in other economic relations, larger, more powerful and more delicate instruments pay only where the demand for their products is large, so credit machinery of given size and fineness needs a certain population for its most efficient service. Increasing population means, moreover, greater density and greater solidarity, greater complexity of business relations and extended economic interdependence. These changes broaden and deepen the mutual knowledge and confidence which form the basis of all credit transactions. They thus stimulate the growth of credit while at the same time they render credit payments easier and cheaper by improving means of communication and transportation.

The increase in the efficiency of existing credit machinery cannot be secured indefinitely, however. There is a limit to its refinement, and the rate of increase of credit payments must ultimately decrease. The first argument to prove this "slowing up" of the increase of credit-paper in payments is found in the necessities of mathematical theory. The percentage of credit-paper in the medium of payment cannot exceed 100; but the population of the group to which the highest percentage belongs may be many hundred or thousandfold the smallest group. To speak algebraically, the value of y in the curve cannot exceed 100; that of x may be indefinitely large. Hence, the curve must tend to become parallel to the axis of x. In the second place, the necessity of mathematical theory is supported by that of practical economic life. As population grows, the proportion of people of small incomes increases. But the small incomes mean purchases of small amounts at a time and, therefore, less use for banking. If retail trade is much subdivided and numerous retail shops are scattered throughout the community, the habit of making small and frequent purchases is stimulated. People do not buy ahead more than they must. In Germany, for example, where retail shops of every kind are found in nearly every block of houses, and sell quantities of their wares that to Americans seem ridiculously small, no housekeeper need buy necessaries in amounts that exceed the needs of half a day, at most. The ease of buying at any moment just what is needed promotes small and frequent purchases, and stimulates ready money payments. What influence "department stores" will have on this habit is an interesting question.

There is, too, a growing tendency to shorten the period of payment of wages and salaries. Hence the recipients get smaller sums at a time and the disbursement of money is less difficult. Many who bought on credit when the wage, or salary, period was a month, or a quarter year, will buy for cash when the period is only a week; and the payments being smaller, money is more convenient than checks. This greater use of money as incomes become smaller, or are more frequently paid, is a matter concerning which it is very difficult to get any direct evidence. From one source, however, we get a little light. The smaller purchases and payments necessitate a greater use of money of the lower denominations. Now there is some evidence that the proportion of these denominations becomes greater as population grows. Mr. J. B. Martin, writing of the circulation of Bank of England notes between 1844 and 1878, remarks:

> There is no material alteration in the demand for bank notes of intermediate values, but in the case of those of the highest and lowest denominations the change is very remarkable. The circulation of £5 notes here is seen to have doubled itself in actual volume, and to have risen 12 per cent. in its ratio to the total circulation, while the circulation of £1,000 notes has diminished by more than half in actual volume, and 12 per cent. in its ratio to the total circulation. . . . . There can be but little doubt that the increase of banking facilities has tended to the settlement of all but very small accounts by check, but the increase of population, the greater amount of business done, and, I hope we may add, the greater prosperity of the masses, have caused a still more rapidly increasing number of these small accounts to demand their settlement by bank notes.[1]

Similar evidence could doubtless be produced from the history of our own currency. Support of our thesis is found, thirdly, in the method of settlement of clearing-house balances. In New York, for example, money is used to a larger extent for this purpose than in many smaller places. At the time when statistics concerning credit-paper in deposits were secured, the statistics of clearing-house operations were asked for, including the method of settling balances. The returns show[2] that a larger proportion of the balance was paid in money in New York city than in most of the smaller cities. New York used $2,971,000 in United States notes, and $3,950,000 in United States currency certificates to settle her balance of $6,921,000 on the day in question.

[1] *Journal of the Institute of Bankers*, vol. i. p. 288.

[2] See the *Report of the Comptroller of the Currency*, 1896, p. 97.

Atlanta, Denver, Louisville, and many other places paid their clearing-house balances entirely by manager's checks. Yet it is in New York city that credit machinery is most delicate and extended. The explanation is very simple. The more complex and delicate the credit machinery the larger the *minimum* debt which it will pay to discharge through it. In a small place, with a single bank, whose bookkeeping is simple and whose office expenses are small, it may pay to handle checks for so small an amount as a dollar, or even 50 cents. There is no clearing house to go through, no duplication of transfers and other records. The case is quite different in the great credit centers. The credit machinery of New York is too costly to use on sums so small. It is easier and less expensive to make such payments in money. And we cannot insist too strongly on the point that a commercial community will always choose the least expensive method of payment. Another bit of evidence is found, perhaps, in the diminution of the percentage of credit-paper in bank deposits for the United States since 1881.[1] The writer has criticised the opinion that this falling off has been taken to mean a permanent diminution of the use of credit. We probably find the true explanation in the thesis we are now discussing. We may have been passing through the depression of a wave of our curve.

Interesting as are the first two conclusions drawn from our statistics, it is the third which is, perhaps, most remarkable. This is, that the growth of the use of credit paper in payments has a periodic character. Are there any logical reasons in support of the statistical evidence? Or must we look upon the upward and downward course of the curve as a curious incident, an accident of these particular data, and of no significance? We must emphasize anew our general principle, that when a community has a choice of means of payment, it will select the mode, or combination of modes, that is least costly. Let us suppose the case of a community of given size and volume of business. Its paying medium consists of money and credit-paper. There is a certain amount of ready money directly used, a certain amount used as a basis for the emission of credit-paper, and a certain amount of credit-paper is actually used from day to day. Population and business may increase, for a time, without making necessary an increase in the amount of money used directly, or to support the credit system. The existing money basis may be made to serve, for a time,

[1] See this JOURNAL, March 1897, p. 173.

as basis for an extended credit, by using a more refined credit system, a more complex and delicate credit machinery. Ultimately, however, the need for still more paying medium must be supplied in some other way.

Moreover, there comes a time in the growth of a community, when the difficulty of using credit payments between its center and its outskirts is as great as it was between two nearer neighborhoods, before the population became large and dense enough to admit of a highly developed credit system; and the expense of such a credit system in the thinly settled portions of the community is too great to justify its maintenance. It is cheaper to use more ready money. There comes a time, too, as we have seen, when there occurs a rise in the minimum amount for which it pays to use the existing credit machinery. This minimum can be reduced again only by an extension of the credit machinery through the investment of new capital. But before this is done, a period elapses during which it is cheaper to use more ready money. The money can be obtained in just the amount needed, while the minimum amount of capital that it would pay to invest in credit machinery would produce a larger extension of the system than the situation demanded. When the amount of a certain kind of work is small, we do it by hand labor; when it is large, we use machinery. When our need for goods is small, we buy at retail; when it is large, we buy at wholesale. So when our need for more paying medium is small, we buy it as we need it—in the shape of ready money; when our need is large, we supply it, and anticipate further needs, by new investment of capital in extending the credit system. When demand for medium of payment presses on supply, the sequence of development is, then: first, the refinement of the existing credit machinery to its maximum efficiency, then a period during which it is less costly to supply the new demand by means of ready money, and, third, the expansion of the credit machinery by the investment of new capital. Of course, these stages of growth are not in fact distinct. Doubtless the money supply may increase, and the credit machinery be both refined and enlarged simultaneously.

There must, consequently, be a fluctuation, an alternate expansion of the circulating money part and of the credit part, of the medium of exchange. But this alternation is not simple. It is a complex movement of several series of fluctuations, of different sweep, or amplitude. Each community which uses credit is, in a measure, independent of

others in supplying itself with a medium of payment. As its need increases, it refines its credit system. When the point is reached where no further expansion is feasible on the basis of its internal means, it draws on the neighboring communities with which it forms an intermediate group, so to say, in the interdependent national trade organization. The undulatory movement is felt in time by this whole group. It in turn relies at first on itself to supply new needs, but in time must press on similar groups in the world's exchange area. Thus we should expect a series of undulations, included one within another. The period between the points when it will be necessary either to get more money or make a new investment in credit machinery will, therefore, be longer where the credit machinery is extensive. That is, the sweep of the undulations should increase as communities grow. This is in accord with the showing of our curve.

It is easy to find arguments in support of the fourth inference from our statistics, concerning the relation of the economic character of a community to its use of credit-paper. The data of 1896 show clearly that differences exist. In what we may call residence cities the percentage of checks is high.[1] This is true, too, of college towns, where the college body is an important part of the population.[2] Agricultural communities show larger use of credit instruments than do manufacturing centers of similar size.[3] The reasons for these differences are not far to seek. The population of the residence, and the college, towns usually includes a large proportion of people with means enough to enable them to have bank accounts. Moreover, the incomes of many, perhaps of most, such people is usually received monthly or quarterly; at intervals, that is, favorable to the use of banking. The banking habit is promoted, too, by the high average intelligence and knowledge of such a population.

In agricultural communities ready money is not always to be had. The farmers' payments come at intervals, in considerable sums, for the sale of his products, and not uncommonly in the form of checks on a bank in some neighboring center. It is usually easier for him to deposit such checks and open an account on which he draws in payment of his own purchases. In a manufacturing village, on the other hand, where the income of a large number of people is in wages, usually paid weekly,

[1] Such as suburbs of large cities, like Brookline, Mass.

[2] Such as Amherst, Mass.; Ann Arbor, Mich.; Evanston, Ill.

[3] Of course, we are discussing the retail data here.

the sum each receives is not large enough to make it worth while for him to deposit and draw on the amount; his creditors are near, easily accessible; and it is less trouble and expense for him simply to apportion the money among them. Besides, the large number of foreigners in our manufacturing centers have not acquired the banking habit to such an extent as the people in the agricultural and residence towns; and possibly the average of education, of the kind which develops this habit, is lower in the manufacturing centers.

All this has to do, however, only with the *absolute* extent to which the use of credit-paper depends on the economic and social character of a community. There is no reason for thinking that a society which was purely manufacturing, or purely agricultural, in short, homogeneous, would show for successive population groups any different law of development of the use of credit instruments from the one already set forth. For the communities of a purely industrial society, like those of any other, would choose the method of payment which for the moment was least costly. All that has been said about the changing expensiveness of the various media of payments would apply to a homogeneous industrial society. Hence, in the absence of positive evidence to the contrary, we are justified in thinking that the *development* of the use of credit-paper in payment as population grows, is independent of industrial character; although as we have seen, the *absolute* percentage largely depends upon it.

We turn now to a question of vital importance for the practical value of our argument. Our data are static. May we interpret them dynamically? They show the relative proportions of credit-paper used in payment by different population groups at the *same time*. May they be taken to show the mode of growth of the use of credit-paper by the *same* community at *different times?* Does the whole country, does the business world, behave in the way indicated? There is no reason for thinking otherwise. According as the population groups from which the percentages are drawn are more or less typical, the more or less closely will they yield points through which a typical group *must pass as it grows*. The whole country, or the whole business world, so far as credit relations permeate it, is, with its multifarious economic conditions, the true typical group. A sit grows it passes through phases corresponding to those we have here observed. For we have seen that as the relative magnitude of different industrial groups changes, the change affects the proportion of credit-paper used, but not the course of development of the check habit.

Our conclusions then may be set down as general. They describe the course which the business world follows in meeting its need for a payment's medium, under existing conditions. Of course we cannot think that the curve which our statistics have furnished shows all the fluctuations of a curve for the whole business world. If we had statistics for the whole world, we should doubtless find waves of greater amplitude, periods of longer sweep, within which those of our data would fall as lesser series. The argument is that the *character* of the movement is revealed by our data and their graphic representation.

But of what practical value is all this? Does it throw any new light on the money question? It certainly does not tell us anything about the absolute amount of money that a community uses or needs. But it does throw some light upon the relative accounts used by communities of different size. To bring out its practical bearings, let us imagine a community with a fixed amount of money, a credit system well established, and a growing population and business. We neglect, as before, the demand for currency for wholesale trade. We may call the money needed for actual circulation, A; that used as a reserve for bank credits, B, which furnishes the amount of credit paying medium that we will call C. Then $A + C$ will represent the total volume of payments. In other words, C represents the bank deposits, or more properly that portion of the deposits which at the time in question is in active use. As business grows, a larger amount of payments medium is, of course, needed. In a modern community the demand falls first on the credit machinery. We go to the banks when we need money. The result will be a stretching, or refinement, of the credit system on the basis of the same reserve. In other words, the amount of money used for a reserve will be made to do the largest possible service. But by and by it will not suffice. Then, perhaps the community takes some money hitherto used in making actual payments. B becomes larger at the expense of A, and the new volume of payments, which we will call $A^1 + C^1$, will be greater than $A + C$. But there is a limit to this process. Money cannot be supplied from the amount which is ordinarily used in making average payments. Soon the community must face a condition of stationary business and falling prices, with all the evils and loss incidental thereto. It is possible that a supply of new money is available at a price, but this price may be so high that there is less social loss in permitting the price level to fall

for a time, than in paying the price for a new supply of money. There comes a turning point, however, when the reverse will be true. Then the community will purchase more money; there will be a comparatively sudden rise in the relative proportion of money payments as compared with credit payments.

The supply of money would not, therefore, be steady, even apart from the vicissitudes of mining. If gold and silver mining were of a character such that a steady supply could be relied upon to meet the varying demands, we still would find periods of sudden increases and relatively sudden degrease of the volume of metallic money as against the volume of credit payments. We appear at present to be passing through a period of relative increase of metallic money. The past twenty-five or thirty years has been a period of relative increase of the use of credit payment. But the credit machinery has apparently been strained beyond the point where the existing amount of metallic money constitutes an adequate reserve. The world, therefore, was confronted with a régime of falling prices. That this fallen price level has been a great hardship to many, there can of course be no denying. But if our reasoning is correct, it must be true that the world has suffered less from the fallen price level than it would have suffered by changing its policy and increasing the volume of metallic money. Otherwise it would have done so.

If these conclusions are correct, they suggest certain matters of importance. It would appear (1) that the world will get a new money supply when it really needs it. It would seem (2) that an artificial increase of the supply of money by such devices as bimetallism would only be a temporary expedient. It would not change the law of the growth of the relative volumes of credit payments and specie payments. It would simply substitute a higher price level for the existing price level for a time. It would seem (3) that an artificial stimulus of the credit machinery is also undesirable because it hastens the time when the community will need a larger amount of metallic money in order to avoid the evils of falling prices. We cannot here, of course, elaborate these points, but the argument of the article seems to point to their truth.

A few words may be added as to the light thrown by our data on the distribution of money. The phrase "distribution of money" admits of a double meaning. It may signify either the movement of money from place to place, or the division of the existing quantity

among different countries or groups of people. It is in the latter sense that the subject has always roused the greater popular interest, but it is in the other sense that distribution has received the fuller scientific treatment. The classical theory is a law of movement, not of apportionment. It tells us that the gold flows from areas of high price-pressure to those of low price-pressure, but it says nothing about the relative amounts, or about the composition, of the exchange medium used by different communities. How much money a community uses, absolutely, or in comparison with other communities of the same general economic character; what is the composition of its medium of payment; what proportion of its payments are made with money and what by means of credit; and how, as a community grows, the constituents of its medium of exchange alter with reference to one another, are questions of much interest and importance which the classical theory does not touch, and to which our existing knowledge offers unsatisfactory answers, if it offers any at all.

Our curve, if inverted, shows the course of the increasing money supply for growing population and business. Its progress is the counterpart, or complement, of the credit-paper portion of the payments medium. It is clear that the ratio of increase of money is by no means one of simple proportion. Indeed, the curve makes it evident that for a time the amount of money may relatively decrease with population and business growing. This, of course, is a well-known fact. But in no case does it appear that expanding business calls for a steady and proportionate increase in metallic money. The amount may be less or more than proportionate and is never steady in its growth.

DAVID KINLEY.

UNIVERSITY OF ILLINOIS.